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Agriculture and Agricultural Science Procedia 10 (2016) 10 – 17

Agriculture and Agricultural Science Procedia

5th International Conference "Agriculture for Life, Life for Agriculture"

Soybean demonstration platforms: the bond between breeding, technology and farming in Central and Eastern Europe

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Abstract

Europe's annual soy and soy derivates consumption is rather high – around 40 million tons grain equivalent – and the European soybeans field production is very low – up to 0.5% of worldwide production.
In Europe, particularly in the European Union, soybean crop was neglected and forgotten; neglected by the policy makers and forgotten by farmers. Neglected and forgotten from both economic and agronomic perspectives.
Over the years, this situation deepened and deepened, today Europe is facing an enormous trade deficit in terms of soy grains, soya-meal and soya oil.
In the past three years we may observe the beginning of a changing paradigm for soybean cultivation. The soybean acreage is increasing, the farmers are reassessing more and more the soybeans in the field crops rotation and the governments started to introduce additional incentives to stimulate the development of soybean crop. This trend is noticeable particularly in Central and Eastern Europe/Danube Region, the most favorable area for soybeans in Europe.
Under these circumstances, the farmers' need for information and know-how transfer become a critical factor for success.
One of the powerful tools for farmer information is the demonstration platform. The demo platform is the place where farmers can visit and discuss about various soybeans technological plots and different soybeans varieties and where the breeders can display their newly and old but improved genotypes. Definitively, the demo platform is the bond between breeding, technology and farming.

Peer-review under responsibility of the University of Agronomic Sciences and Veterinary Medicine Bucharest

Keywords: soybeans; demonstration platform; experimental plots; soybeans technology; soybeans breeding; farming.

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Peer-review under responsibility of the University of Agronomic Sciences and Veterinary Medicine Bucharest
doi:10.1016/j.aaspro.2016.09.003

1. Introduction

Europe's annual soy and soy derivates consumption is rather high – around 40 million tons grain equivalent – and the soybeans field production is very low – up to 0.5% of worldwide production.

In Europe, particularly in the European Union, soybean crop was neglected and forgotten; neglected by the policy makers and forgotten by farmers. Neglected and forgotten from both economic and agronomic perspectives.

Over the years, this situation deepened and deepened, today Europe is facing an enormous trade deficit in terms of soy grains, soya-meal and soya oil (Figure 1).

As example, the 28 countries of the European Union imported in 2013 large quantities of soya grains (13.5 million tons), soya-meal (19.6 million tons) and soya oil (0.3 million tons) from only overseas countries.

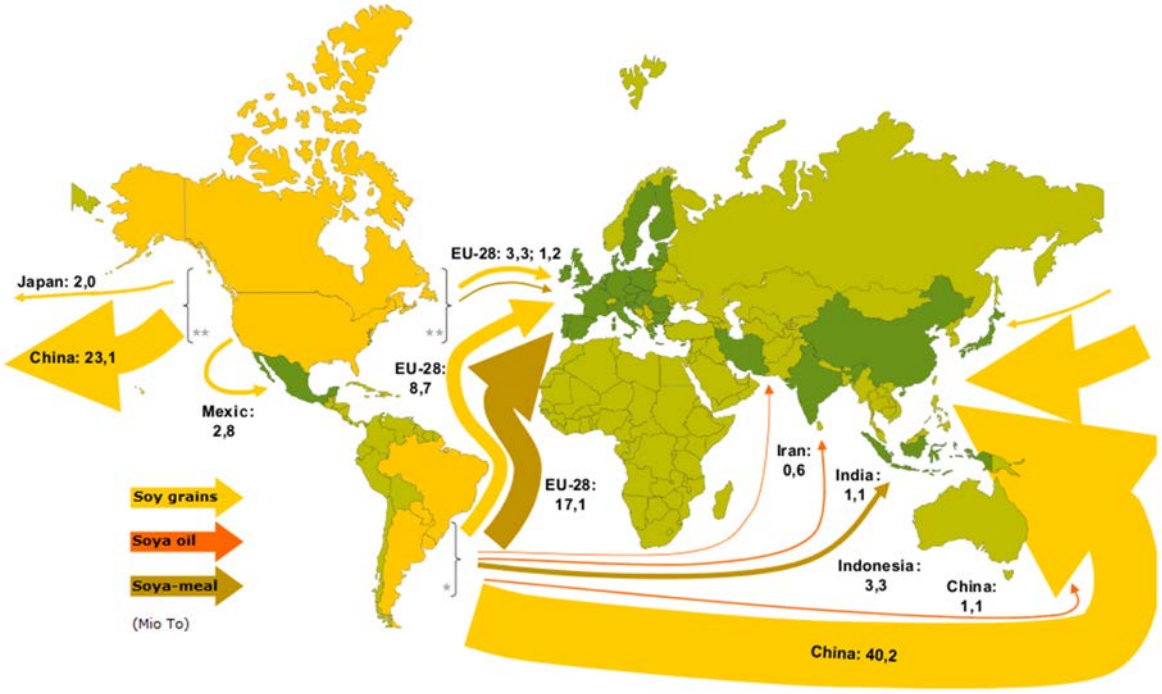

Fig. 1. 2013 EU-28 inflow of soy grains, soya oil and soya-meal.

Ranking according to the volumes exported, these countries are Brazil, Argentina, Paraguay, United States and Canada.

In total, 95% of Europe's annual consumption is based on imports. Serbia is the only country in Europe able to supply the annual soybean consumption from its local field production.

Nevertheless, Europe can and should rebalance its sources of soybeans supply. The most favorable area for cropping soybeans is the Danube Region, the Eastern and Central part of Europe (Krön et al., 2015).

In the past three years we may observe the beginning of a changing paradigm for soybean cultivation. The soybean acreage is increasing, the farmers are reassessing more and more the soybeans in the field crops rotation and the governments started to introduce additional incentives to stimulate the development of soybean crop.

From 2013 to 2015, Romania increased the soybean area from 67,400 Ha to 185,000 Ha.

Bulgaria faced even a more dynamic increase of the soybeans acreage, from 600 Ha in 2013 to 29,500 Ha in 2015 (Figure 2).

In 2015 soybean area in Europe expanded to 3.2 million hectares, from 2.6 million hectares in 2014 and 2 million hectares in 2013.

Due to the increasing interest of the farmers in the reassessing the soybeans from both agronomic and

commercial perspectives and the government support for protein crops the soybean acreage growth trend will continue. In 2015 Bulgaria, Croatia, Czech, France, Hungary, Italy, Poland, Romania and Slovenia introduced Voluntary Coupled Support (VCS), in addition to the Single Area Payment System (SAPS).

2. Materials and Methods

This research was accomplished based on the observations and gathering of field experimental data in demonstration platforms organized in two soybeans cropping areas of Romania namely South-East and Central. The information and data collected covers two consecutive past years, 2014 and 2015.

In addition, this study benefited of the valuable opinions and concerns coming from professors, breeders, researchers and farmers from Romania and Bulgaria.

The scope of this paper - in particularly - and the development of demo platforms - in general - is to bring as much information regarding soybeans field technology into the attention of farmers and other interested stakeholders.

In Europe, particularly in the European Union, soybean crop was neglected and forgotten; neglected by the policy makers and forgotten by farmers. Neglected and forgotten from both economic and agronomic perspectives.

However, in the past three years we may observe the beginning of a changing paradigm for soybean cultivation, the soybean acreage is increasing.

Under these circumstances, the farmers' need for information and know-how transfer become a critical factor for success.

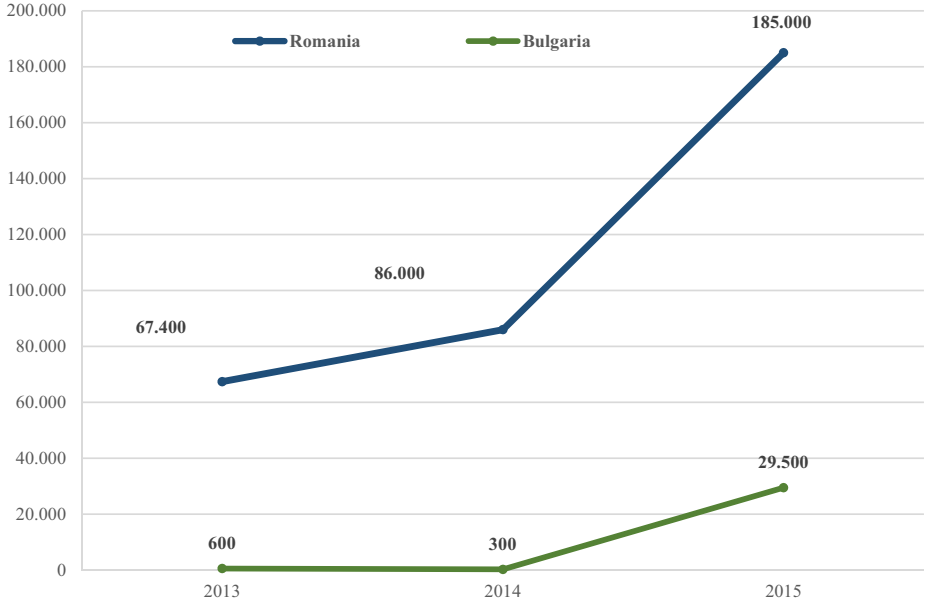

Fig. 2. 2013 2013-2015 soybean acreage in Romania and Bulgaria.

3. Results and Discussions

Although the national legislation of each EU member state allows the cultivation of any soybean variety listed in the EU Common Catalogue of Varieties of Agricultural Plant Species, there is little consolidated information regarding the field behaviour of a listed soybean variety under specific soil and climate conditions from one or another country.

In the past 25 years, the decrease of soybean acreage in Central and Eastern Europe created a technological gap and an information shortage.

With the exception of few professional big farmers, many of small and medium size farmers did not crop soybeans on large scale in the past 10 years.

However, due to financial attractiveness in 2014 and 2015 a lot of farmers started to plant soybeans, plenty of them with little or no knowledge on soy technology.

For having a profitable yield, a farmer is called for a number of decisions regarding the technology for soybean crop.

From selecting the right genetic quality and maturity group of the seed to applying the optimal crop protection chemicals there are many technological factors influencing the quality and quantity of the yield.

Among these factors seeding density is influencing both the costs and the revenues. The adequate density will support the optimization of the costs and will maximize the yield (Roman, 2015).

During past two years (2014 and 2015) experimental plots with seeding density have been organized under the demo platforms in Turda and Fetesti in Romania (Figure 3).

Placed in different regions of Romania both locations are situated in favorable areas for soybeans but having other conditions in terms of climate and rainfall.

The climate conditions of 2014 and 2015 in Turda are presented in Table 1 - temperature and Table 2 - rainfall.

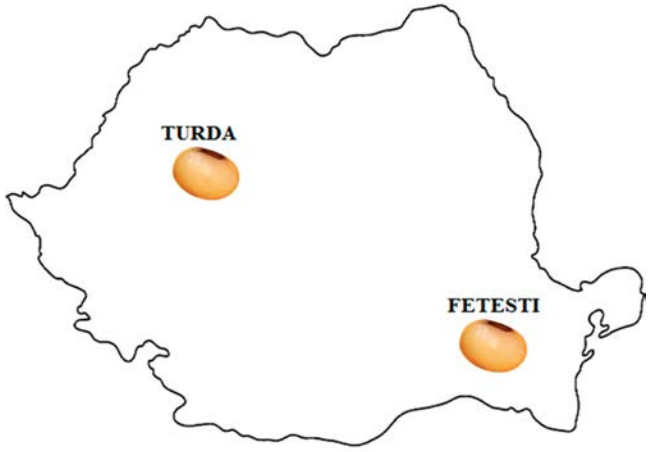

Fig. 3. Demo platform locations Turda and Fetesti.

Table 1. Average air temperature 2014 and 2015 in Turda.

Average air temperature (°C)	2014								
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
Decade I	0.3	0.9	7.1	10.9	13.2	18.4	19.7	22.1	19.5
Decade II	2.0	5.6	8.5	9.4	13.8	18.9	20.6	21.1	18.1
Decade III	-0.6	5.2	10.7	13.8	17.9	18.1	20.9	16.8	12.4
Monthly average	0.5	3.8	8.8	11.4	15.1	18.5	20.4	19.9	16.6
Average 55 years	-3.5	-0.9	4.1	9.8	14.7	17.7	19.6	19.2	14.9
Deviation	+4.0	+4.7	+4.7	+1.6	+0.4	0.8	+0.8	+0.7	+1.7
Characterization	warm	warm	warm	hot	normal	normal	normal	normal	hot

Average air temperature (°C)	2015								
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
Decade I	-6.6	-2.1	3.5	4.8	15.7	21.4	22.4	23.6	18.6
Decade II	0.6	-2.9	4.6	11.7	15.1	20.0	21.4	21.3	18.8
Decade III	3.5	8.2	8.1	12.1	16.4	16.8	23.0	21.0	14.5
Monthly average	-0.7	0.6	5.5	9.6	15.8	19.4	22.3	21.9	17.3
Average 55 years	-3.5	-0.9	4.1	9.8	14.7	17.7	19.6	19.2	14.9
Deviation	+2.8	+1.5	+1.4	-0.2	+1.1	+1.7	+2.7	+2.7	+2.4
Characterization	warm	hot	hot	normal	hot	hot	warm	warm	warm

Table 2. Precipitation 2014 and 2015 in Turda.

Precipitation (mm)	2014								
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
Decade I	5.2	0.2	4.0	19.0	19.0	6.2	50.0	27.6	10.4
Decade II	2.1	8.7	10.1	38.6	26.8	10.2	29.8	18.6	3.2
Decade III	44.3	6.6	9.0	14.4	20.4	32.0	64.6	37.6	34.8
Monthly sum	51.6	15.5	23.1	72.0	66.2	48.4	144.4	83.8	48.4
Average 55 years	21.3	18.7	23.1	44.7	67.7	84.5	76.7	55.9	40.3
Deviation	+30.3	-3.2	0.0	+27.3	-1.5	-36.1	+67.7	+27.9	+8.1
Characterization	rain in excess	some draught	normal	rain in excess	normal	very dry	rain in excess	very rainy	some rain

Precipitation (mm)	2015								
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
Decade I	9.2	13.6	3.2	11.8	14.4	0.6	14.8	0.0	55.0
Decade II	1.1	0.4	3.2	3.0	20.2	59.5	9.0	72.2	20.8
Decade III	2.0	6.9	6.4	17.4	31.4	55.6	28.4	0.0	96.8
Monthly sum	12.3	20.9	12.8	32.2	66.0	115.7	52.2	72.2	172.6
Average 55 years	21.3	18.7	23.1	44.7	67.7	84.5	76.7	55.9	40.3
Deviation	-9.0	+2.2	-10.3	-12.5	-1.7	+31.2	-24.5	+16.3	+132.3
Characterization	very dry	some rain	very dry	draught	normal	some rain	very dry	rainy	rain in exces

The climate conditions of 2014 and 2015 in Fetesti are presented in Table 3 - temperature and Table 4 - rainfall.

The soybean variety planted in Turda was Felix, maturity group 00, registered in 2005 by the breeder the Agricultural Research and Development Station Turda, Romania (Muresanu et al., 2010).

In both years the planting was done at 50 cm between rows.

In Turda the experimental plots were located at the following GPS coordinates: 46.592373, 23.811661 in 2014; 46.586801, 23.810277 in 2015.

The soybean variety seeded in Fetesti was Daciana, maturity group 0, registered in 2006 by the breeder the National Agricultural Research and Development Institute Fundulea, Romania (David, 2007).

In both years the planting was done at 37,5 cm between rows.

Table 3. Average air temperature 2014 and 2015 in Fetesti.

Average air temperature (°C)	2014								
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
Decade I	3.7	0.9	5.2	10.7	14.3	19.3	22.0	23.6	19.9
Decade II	2.7	0.6	6.9	10.7	15.8	20.1	22.4	24.2	18.0
Decade III	2.5	3.4	10.4	13.9	18.4	18.9	22.7	21.6	15.0
Monthly average	2.9	1.6	7.5	11.7	16.1	19.4	22.3	23.1	17.6
Average 55 years	-1.60	0.5	3.6	9.3	15.2	18.4	20.1	22.9	16.8
Deviation	+4.50	+1.1	+3.9	+2.4	+0.9	+1.0	+2.2	+0.2	+0.8
Characterization	warm	warm	warm	warm	normal	normal	warm	normal	warm

Average air temperature (°C)	2015								
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
Decade I	-7.0	1.3	4.8	7.0	16.8	20.1	23.8	25.1	23.1
Decade II	0.7	-1.9	5.0	9.8	17.3	22.2	23.7	24.8	19.0
Decade III	3.5	6.8	7.8	12.0	18.8	20.0	26.8	21.9	18.8
Monthly average	0.7	1.5	5.7	10.5	17.8	20.8	24.7	23.7	20.0
Average 55 years	-1.6	0.5	3.6	9.3	15.2	18.4	20.1	22.9	16.8
Deviation	+0.9	+1.0	+2.1	+1.20	+2.6	+2.4	+4.6	+0.8	+3.2
Characterization	normal	warm	warm	normal	warm	warm	warm	normal	warm

Table 4. Precipitation 2014 and 2015 in Fetesti.

Precipitation (mm)	2014								
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
Decade I	0.8	7.8	53.0	1.4	11.8	43.6	17.2	0.4	1.8
Decade II	0.6	0.8	6.0	17.6	14.4	40.6	4.8	44.2	0.0
Decade III	5.6	0.8	1.0	3.6	48.4	29.2	0.4	15.2	27.3
Monthly sum	7.0	9.4	60.0	22.6	74.6	113.4	22.4	59.8	29.0
Average 55 years	17.4	16.3	22.5	32.1	65.8	67.7	38.2	39.6	32.2
Deviation	-10.4	-6.9	+37.5	-9.5	+8.8	+45.7	-15.8	+20.2	-3.2
Characterization	draught	some draught	rainy	some draught	normal	rainy	draught	some rain	some draught
Precipitation (mm)	2015								
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep
Decade I	5.8	34.4	29.8	32.0	0.4	7.0	0.2	0.2	0.0
Decade II	17.0	13.6	1.0	7.4	0.0	0.2	0.4	56.0	0.6
Decade III	10.7	12.0	65.2	1.4	0.0	0.4	0.0	0.4	25.8
Monthly sum	33.5	60.0	126.8	40.8	0.4	1.3	0.6	56.6	26.4
Average 55 years	17.4	16.3	22.5	32.1	65.8	67.7	38.2	39.6	32.2
Deviation	+16.1	+43.7	+104.3	+8.7	-65.4	-66.4	-37.6	+17.0	-5.8
Characterization	rainy	rainy	rainy	rainy	very dry	very dry	very dry	some rain	some rain

In Fetesti the experimental plots were located at the following GPS coordinates: 44.441135, 27.709255 in 2014; 44.420664, 27.707776 in 2015.

The experimental plots in Turda in 2014 and 2015 displayed 3 seeding densities: 45, 60 and 75 germinating grains per square meter (g.g/m^2) (Roman et al., 2011).

The results obtained in Turda are presented in Table 5.

Table 5. Results obtained on three seeding densities in Turda in 2014 and 2015.

Year	Sowing Date	Density (g.g./m^2)	Plant Height (cm)	Insertion Height (cm)	Yield (kg/Ha)	TGW (gr)
2014	April 23	45	132	21	1866	214
		60	131	18	2200	180
		75	117	19	2400	183
2015	May 5	45	109	15	1761	174
		60	106	15	1562	179
		75	104	18	1711	181

In 2014 the average plant height for Felix variety was virtually the same for both densities of 45 g.g/m^2 and 60 g.g/m^2, 132 cm respectively 131 cm. The lowest plant height of 117 cm was recorded for the density of 75 g.g/m^2. In 2015 the average plant height also showed very similar values: 109 cm for the density of 45 g.g/m^2, 106 cm at 60 g.g/m^2 and 104 cm for the density of 75 g.g/m^2.

The average insertion height of the first basal pods was very good in all 3 densities in 2014. The values range was between 18 and 21 cm; 21 cm for 45 g.g/m^2, 19 cm for 75 g.g/m^2 and 18 cm for 60 g.g/m^2. In 2015 the average insertion height of the first basal pods registered very similar or equal values in some cases: 15 cm for both densities of 45 g.g/m^2 and 60 g.g/m^2 and 18 cm for the density of 75 g.g/m^2.

In 2014 the highest yield of 2400 kg/Ha was obtained at the density of 75 g.g/m^2 followed by 2200 kg/Ha at 60 g.g/m^2 and 1866 kg/Ha for the density of 45 g.g/m^2. In 2015 the highest yield of 1761 kg/Ha was obtained at the density of 45 g.g/m^2; second yield of 1711 kg/ha was obtained at 75 g.g/m^2; the last ranked obtained yield was 1562 kg/Ha for the density of 60 g.g/m^2.

In 2014 the highest TGW value of 214 grams was registered for the density of 45 g.g/m^2; next was 183 grams for 75 g.g/m^2 followed by 180 grams for the density of 60 g.g/m^2. In 2015, TGW has registered very similar values, being noticed a slight superiority for the densities of 75 g.g/m^2 (181 grams) and 60 g.g/m^2 (179 grams). The lowest TGW value (174 grams) was recorder for the density of 45 g.g/m^2.

In 2014 and 2015 three experimental plots in Fetesti displayed 3 seeding densities: 50, 60 and 70 germinating grains per square meter (Roman et al., 2011).

The results obtained in Fetesti are presented in Table 6.

Table 6. Results obtained on three seeding densities in Fetesti in 2014 and 2015.

Year	Sowing Date	Density (g.g./m^2)	Plant Height (cm)	Insertion Height (cm)	Yield (kg/Ha)	TGW (gr)
2014	April 14	50	132	11	3080	162
		60	132	12	3160	160
		70	120	10	3050	158
2015	April 22	50	114	11	3290	176
		60	115	12	3380	174
		70	118	12	3220	173

In 2014 for both seeding densities of 50 g.g/m^2 and 60 g.g/m^2 average plant height recorded same value of 132 cm. For the density of 70 g.g/m^2 the plant height was lower, respectively 120 cm. Under 2015 conditions, both plant height and height insertion of the basal pods recorded very close or same values in some cases. The plant height was 114 cm at a density of 50 g.g/m^2, 115 cm for 60 g.g/m^2 and 118 cm at the density of 70 g.g/m^2.

In 2014 the average insertion height of the first basal pods was registering close values in all 3 densities, respectively 10 cm for 70 g.g/m^2, 11 cm for 50 g.g/m^2 up to 12 cm for the density of 60 g.g/m^2. In 2015 the insertion height of the basal pod was 11 cm at the density of 50 g.g/m^2 and 12 cm at both densities of 60 g.g/m^2 and 70 g.g/m^2.

Under specific conditions of 2014, Daciana soy variety obtained the highest yield of 3160 kg/Ha at the density of 60 g.g/m^2. For the densities of 50 g.g/m^2 and 70 g.g/m^2 the yield was similar, respectively 3080 kg/Ha versus 3050 kg/Ha. In 2015 the highest production of 3380 kg/Ha was obtained at the density of 60 g.g/m^2 followed by 3290 kg/Ha for and 3320 kg/Ha for 70 g.g/m^2.

In 2014, TGW recorded similar values in the 3 densities, ranging from 162 grams for 50 g.g/m^2 and 160 grams for 60 g.g/m^2 and 158 grams for 70 g.g/m^2. In 2015, TGW has registered very similar values with a slight superiority at the density of 50 g.g/m^2, respectively 176 grams versus 174 grams for 60 g.g/m^2 and 173 grams at 70 g.g/m^2.

4. Conclusions

This paper presented the variations of several output parameters (plant height, insertion height, yield, TGW) for a single technological factor – seeding density – in same two locations in two consecutive years, 2014 and 2015.

The climate conditions in the two consecutive years also recorded significant differences.

The observations for seeding densities will be carried-out in the following years not limited to the above mentioned locations but through-out the entire region.

The results will be available to farmers and other interested soybean stakeholders.

Soybeans is a versatile crop also from the seeding point of view. The farmer doesn't need a specific planting equipment. Seeding can be performed either with row crop planter (e.g. Turda) or with small grains drill (e.g. Fetesti).

The demonstration platform is a multi-purpose vehicle. On one side, the farmers have the opportunity to get in contact with soybeans varieties from different groups created by national or European breeders and to obtain information regarding soybeans technological components such as time of sowing, distances between rows, seeding densities, bacterization, weed control, fertilization and micro-elements. On the other side, the breeders have the chance to display their new or old but improved creations of soybean genotypes.

Acknowledgements

This research was carried out with the support of:

- Prof. dr. Gheorghe Valentin Roman, University of Agronomic Sciences and Veterinary Medicine Bucharest, Romania;
- Dr. Eugen Mureşanu, Agricultural Research and Development Station Turda, Romania;
- Dr. Raluca Rezi, Agricultural Research and Development Station Turda.

References

David, I., 2007. Achievements in grain legumes breeding, AN. N.A.R.D.I. Fundulea, VOL. LXXV, Jubilee Volume.

Krön, M., Bittner, U., 2015. Danube Soya – Improving European GM-free soya supply for food and feed. OCL - Oilseeds and fats, Crops and Lipids, 22(5) D509.

Mureşanu, E., Negru, S., Mărginean, R., 2010. Early soybean variety "Felix", Genetics and Plant Breeding, AN. N.A.R.D.I. Fundulea, Vol. LXXVIII, Nr. 2.

Roman, Gh.V., 2015. Soybean Crop - Different Aspects. Presentation at Donau Soja Conference, Drajna.

Roman, Gh.V., Tabara, V., Pirsan, P., Axinte, M., Stefan, M., Robu, T., 2011. Field Crops - Cereals and Grain Legumes, Vol. I. "Universitara" Publishing House, Bucharest.

The Official Catalogue of crop plants varieties in Romania - complete edition 2014. The State Institute for Variety Testing and Registration, Bucharest, 2014.